What is claimed:

1. A solid freeform fabrication method for fabricating a multi-material three-dimensional object from successive layers of a primary body-building powder material, at least a modifier powder, and a binder powder in accordance with a computer-aided design of the object, said design comprising geometry and material composition data, said method comprising:

(a) providing a work surface;

(b) feeding a first layer of said primary body-building powder material to said work surface;

(c) operating an electrophotographic powder deposition means to create transferable images of said at least a modifier powder and said binder powder image in accordance with said design;

(d) transferring said transferable powder images to said first layer of primary body-building powder material;

(e) applying energy means to fuse said binder powder, forming a binder fluid to permeate through said first layer of primary body-building material for bonding and consolidating the powder particles in said first layer to form a first cross-section of said object;

(f) feeding a second layer of said primary body-building powder material onto said first layer and repeating the operating, transferring, and applying steps to form a second cross-section of said object;

(g) repeating the feeding, operating, transferring, and applying steps to build successive layers in a layer-wise fashion in accordance with said design for forming multiple layers of said object; and

(h) removing un-bonded powder particles in said multiple layers, causing said 3-D object to appear.

2. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said steps of applying energy means comprise pre-heating a layer of primary body-building powder material to a temperature above the melting point of said binder powder.

3. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said

binder powder comprises a resin composition that can be cured or hardened with heat, ultra violet light, electron beam, ion beam, plasma, microwave, X-ray, Gamma ray, or a combination thereof.

4. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said steps of applying energy means are carried out in such a manner that said successive layers are affixed together to form a unitary body of said 3-D object.

5. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said fused binder fluid is allowed to solidify once permeating through the gaps between powder particles of a layer of primary body-building material.

6. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said electrophotographic powder deposition means comprises devices selected from the group consisting of a corona discharging device, capacitor dot matrix charging device, thin photoconductive layer, scanning laser imaging device, charge cleaning device, and combinations thereof.

7. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said primary body-building powder material is selected from the group consisting of fine polymeric, glassy, metallic, ceramic, and carbonaceous particles, and combinations thereof.

8. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein steps (c) and (d) comprising operating said electrophotographic powder deposition means to create a transferable image of said at least a modifier powder and transferring said modifier powder image to said first layer of primary body-building powder material and, in sequence, operating said electrophotographic powder deposition means to create a transferable image of said binder powder and transferring said binder powder image to said first layer of primary body-building powder material.

9. The method for fabricating a three-dimensional object as set forth in claim **1**, comprising the

further steps of:

providing a control means operably connected to said electro-photographic powder deposition means; and

supplying the control means with design data including geometry and material composition distribution of each cross-sectional region of said object.

10. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said at least a modifier powder comprising at least a colorant.

11. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said at least one modifier powder comprising at least first, second and third modifier powders containing, respectively, cyan, magenta, and yellow colorants and wherein said steps (c) and (d) comprising creating images of said first, second and third powders at predetermined colorant proportions and transferring said images to said first layer of primary body-building powder at a predetermined sequence.

12. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein said feeding of powder layers is accomplished by using a dispensing means comprising a rotating drum.

13. The method for fabricating a three-dimensional object as set forth in claim **1**, wherein the powder feeding step comprises the steps of:

positioning a powder-dispensing means at a predetermined initial distance from said work surface;

operating and moving said powder-dispensing means relative to said work surface along selected directions in an X-Y plane to dispense and deposit a thin layer of powder on said work surface, said X-Y plane of an X-Y-Z Cartesian coordinate being defined to be substantially parallel to said work surface and the Z-axis being perpendicular to said X-Y plane; and

after a cross-section of said object is built in said layer, moving said work surface away

from said powder-dispensing means along said Z-direction by a predetermined distance to allow for the feeding and building of a subsequent layer.

14. The method as defined in claim **1**, further comprising the steps of:

creating a geometry of said three-dimensional object on a computer with said geometry including a plurality of data points defining the object;

generating programmed signals corresponding to each of said data points in a predetermined sequence; and

operating said electro-photographic powder deposition means and moving said work surface relative to said electro-photographic powder deposition means in response to said programmed signals.

15. The method as defined in claim **1**, further comprising the steps of:

creating a geometry of said three-dimensional object on a computer with said geometry including a plurality of layer-wise data sets defining the shape and dimensions of the object; each of said data sets for a layer being coded with a selected set of powder material compositions defining the proportions and distributions of said primary body-building powder, said at least modifier powder, and said binder powder in said layer;

generating programmed signals corresponding to each of said data sets in a predetermined sequence;

for each layer to be built, operating a powder-dispensing means to feed a current layer of selected primary body-building powder composition onto said work surface or a previously fed layer;

operating said electro-photographic powder deposition means in response to said programmed signals to create modifier powder and binder powder images and transfer said powder images onto said current layer to bond and consolidate a cross-section of said object in said layer; and

repeating said steps of operating a powder-dispensing means and said electro-photographic powder deposition means to build a multi-material 3-D object.

16. The method as defined in claim **1**, further comprising

using dimension sensor means to periodically measure dimensions of the object being built; and

using a computer to determine the thickness and outline of individual layers of powder materials in accordance with a computer aided design representation of said object; said computing step comprising operating said computer to calculate a first set of logical layers with specific thickness and outline for each layer and then periodically re-calculate another set of logical layers after periodically comparing the dimension data acquired by said sensor means with said computer aided design representation in an adaptive manner.

17. The method as defined in claim **1**, further comprising the operations of burning off said binder after step (h) thereby forming a 3-D porous body and impregnating said porous 3-D body with a solidifying liquid material to form a solid 3-D object.

18. A solid freeform fabrication apparatus for making a three-dimensional object from multiple layers of at least a primary body-building powder, at least a modifier powder, and a binder powder, said apparatus comprising:

(a) a work surface to support said object while being built;

(b) at least a powder-dispensing means at a predetermined initial distance from said work surface, each said dispensing means having an outlet directed to said work surface for feeding successive layers of body-building powder materials onto said work surface one layer at a time;

(c) an electro-photographic powder deposition means disposed at a distance from said work surface for providing modifier powder and binder powder images onto said successive layers of a primary body-building powder material, one layer at a time;

(d) energy means in energy-supplying relation to said work surface and to said successive layers of materials thereon for consolidating said layers; and

(e) motion devices coupled to said work surface, said at least one powder-dispensing means, and said electro-photographic powder deposition means for moving said powder-dispensing means and said electro-photographic powder deposition means relative to said

work surface in a plane defined by first and second directions and in a third direction orthogonal to said plane to dispense and deposit said multiple layers of primary body-building powder, modifier, and binder materials, one layer at a time, for forming said 3-D object.

19. Apparatus as set forth in claim **18**, wherein said at least one powder-dispensing means comprises a powder-feeding drum.

20. Apparatus as set forth in claim **18**, further comprising:

a computer-aided design computer and supporting software programs operative to create a three-dimensional geometry and material composition distribution file of said 3-D object, to convert said geometry and material composition distribution file into a plurality of layer-wise sets of data points defining the object shape, dimensions, and material compositions, and to generate programmed signals corresponding to each of said data points in a predetermined sequence;

said computer being electronically linked to said electro-photographic powder deposition means for sending said programmed signals thereto to create said modifier and binder powder images; and

a motion controller electronically linked to said computer and said motion devices; said motion controller being operative to actuate said motion devices in response to said programmed signals for said data points received from said computer.

21. Apparatus as set forth in claim **20**, further comprising:

sensor means electronically linked to said computer and operative to periodically provide layer dimension data to said computer;

supporting software programs in said computer operative to perform adaptive layer slicing to periodically create a new set of layer data comprising data points defining the object in accordance with said layer dimension data acquired by said sensor means, and to generate programmed signals corresponding to each of said data points in a predetermined sequence.

22. Apparatus as set forth in claim **18**, wherein said electrophotographic powder deposition means comprises devices selected from the group consisting of a corona discharging device, capacitor dot matrix charging device, thin photoconductive layer, scanning laser imaging device, charge cleaning device, and combinations thereof.

23. Apparatus as set forth in claim **18**, wherein said at least one powder-dispensing means and/or said work surface are provided with heating means for pre-heating the primary body-building powder material.

24. Apparatus as set forth in claim **18**, wherein said energy means is selected from the group consisting of infrared, induction heating, dielectric heating, microwave heating, hot-air convective heating, and traditional conduction heating sources, ultra violet, X-ray, Gamma-ray, electron beam, laser beam, ion beam, plasma, and combinations thereof.

25. Apparatus as set forth in claim **18**, wherein said work surface is provided with a protective environment.

26. The method of claim **1**, further comprising additional step of charging a layer of said primary body-building powder material with charges of opposite polarity to those charges created by said electro-photographic powder deposition means to facilitate transfer of a binder powder image to said layer of primary body-building powder material.

27. A method for making a three-dimensional object from layers of a primary body-building porous substrate, at least a modifier powder, and a binder powder, said method comprising the steps of:

positioning a work surface in proximity to, and at a predetermined initial distance from, means for storing and supplying said body-building porous substrate layers;

feeding a first layer of said body-building porous substrate onto said work surface;

electro-photographically depositing images of said at least a modifier powder and said binder powder onto selected areas of said first layer of body-building porous

substrate;

applying energy means to said first layer for consolidating the body-building substrate, modifier, and binder materials in said selected areas for building a cross-section of said object;

repeating said feeding, depositing, and applying steps to form a plurality of layers, each of said layers being integrally bonded to the next adjacent of said layers by said applying steps to form an integral 3-D body imbedded in a stack of binder-free portions of porous substrate serving as a support structure; and

removing said support structure, causing said 3-D object to appear.

28. The method according to claim **27** wherein said layers of porous substrate are pre-heated to a pre-selected temperature.

29. The method according to claim **27**, further comprising additional step of charging a layer of said primary body-building porous substrate with charges of opposite polarity to those charges created by said electro-photographic powder deposition means to facilitate transfer of modifier and binder powder images to said layer of primary body-building porous substrate.